

11-14 YEARS SESSION 3: Using collective action groups to understand measures of central tendency

Subject: Mathematics

Age range: 11-14 years

Time: 1 hour

<p>Outline Learners will be introduced to the concepts of mean, median and mode, and understand the differences between these three measures. Learners will recognise the characteristics of frequency charts in terms of measures of central tendency.</p>		
<p>Learning objectives</p> <ul style="list-style-type: none"> To develop understanding of different ways to calculate measures of central tendency 	<p>Learning outcomes</p> <ul style="list-style-type: none"> Learners will compare mean, median and mode using the same data Learners consider how the shape of frequency distributions affect their averages 	
<p>Key questions</p> <ul style="list-style-type: none"> What impact does using mean, median and mode have on results? What effect does including additional values have on the mean, median and mode? Which measure of central tendency is the best to use? 	<p>Resources</p> <ul style="list-style-type: none"> Slideshow 3 <i>Learner worksheet 3A: Calculating Mean, Median and Mode – Ethiopian Data</i> <i>Learner worksheet 3B: Calculating Mean, Median and Mode from Grouped Frequency Diagrams</i> <i>Spreadsheet: Session 3</i> 	
Curriculum links		
<p>England <i>Mathematics</i> Pupils should be taught to:</p> <ul style="list-style-type: none"> describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers) 	<p>Wales <i>Mathematics Key Stage 3</i> Using data skills: collect and record data, present and analyse data, interpret results</p> <ul style="list-style-type: none"> construct and interpret graphs and diagrams (including pie charts) to represent discrete or continuous data interpret diagrams and graphs to compare sets of data find the mean, median, mode and range from grouped frequency tables and explain why it is an estimate <p>Numeracy Framework: Using data skills</p>	<p>Scotland <i>Numeracy and mathematics</i></p> <p>I can work collaboratively, making appropriate use of technology, to source information presented in a range of ways, interpret what it conveys and discuss whether I believe the information to be robust, vague or misleading. MNU 2 and 3-20a</p> <p>I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams, and graphs, making effective use of technology. MTH 2 and 3-21a</p>



Starter (10 min)

Ask the learners what kinds of information would be interesting to compare in the women who belonged to collective action groups. Slide 3 in Slideshow 3 will support this discussion. They may suggest:

- age
- wealth
- level of education
- marital status
- home owning status
- amount of honey produced

Ask learners what a measure of central tendency or average means. Why might we use an average rather than look at a full data set? Would it be possible to calculate averages for all the suggested areas above? Learners could discuss these questions in pairs or as a group - slide 6 in Slideshow 3 will support this discussion.

Many learners will have learnt how to calculate the mean in primary school (as the only measure of central tendency in the primary curriculum). Some may know the other two measures - the median (middle) or mode (most popular).

Display the definitions of the three measures of central tendency on slide 7 in Slideshow 3.

Activity 3.1 (15 min)

Calculating the mean, median and mode

Using either worksheets 1-8 in spreadsheet: Session 3 or learner worksheet 3A: Calculating Mean, Median and Mode – Ethiopian Data, ask learners to calculate the mean, median and mode for a sample of data for group and non-group members and compare their answers. There are six random samples of 30 women – three with data for WCA group members and three with data for non-group members.

Learners can repeat this process for a selection of different variables for group and non-group members. There are nine variables to choose from. Not all of the variables provide data that is sensible to work out all three measures of central tendency, but this is an important discussion to have with learners. The two most straightforward variables for learners to work with are the amount of honey produced and the percentage marketed.

To complete the activity, learners should write a short paragraph about what the three measures of central tendency tell them, for example, 'The means of XX and YY tell us that group members produced more honey than non-group members.'

It is worth reminding learners that they are using a very small sample of data, so any conclusions drawn will differ from those drawn from the full data set.

Activity 3.2 (15 min)

Drawing a grouped frequency diagram

Display the frequency graph for a random sample of 100 women's honey production on slide 8 in Slideshow 3. This graph has been produced using ungrouped data. Ask learners how we could draw a similar diagram without so many bars. Then lead into an explanation about why grouping data in frequency diagrams makes more sense when plotting large amounts of data.

Discuss how to group the data into equal class widths, then explain how to construct a frequency diagram for this data and show pupils the grouped data table and the final frequency diagram on slide 10 in Slideshow 3. Highlight that there are no spaces between the bars as the distribution is continuous. This is the main difference between a frequency chart/histogram and bar chart. Stress the importance of scale along the x-axis, labelling the ends of the bars, labelling the axis and equal bar widths.

Using one of the same sample data variables as they chose in 3.1 (such as age, wealth or units of honey produced), ask learners to select an appropriate way of grouping the data. Next ask them to draw a grouped frequency diagram to compare group and non-group members.

Finish by asking learners to compare the mean, median and mode they calculated in activity 3.1 to their grouped frequency diagrams and share their observations.

Activity 3.3 (10 min)

Calculating the mean, median and mode from a grouped frequency diagram

Show learners the grouped frequency diagram on slide 10 in Slideshow 3. Ask what they think the mode, mean and median values are. Discuss the problems with finding these values using grouped data. Point out:

- We can only identify the modal class (tallest bar)
- We can only identify the class containing the median
- We can only estimate the mean by using mid-points and frequencies

Work through the steps, with discussion, of how to find the mean from grouped data (in a table or on a grouped-frequency diagram). Slide 11 in Slideshow 2 will support this task.

Learners know how many women fall into each grouped category. Tell learners to assume for this exercise that the women are all at the mid-point of the category. Choosing the lowest or highest point is more likely to make the estimate too big or too small. Learners should multiply the mid-point by the frequency (number of women in that category). They need to do this for each category. Learners then add together the result for each category. The final number is their estimate of the mean.

Give each group learner worksheet 2B: Calculating Mean, Median and Mode from Grouped Frequency Diagrams showing two grouped frequency diagrams (one for the age of women in groups, one for the age of women not in groups). From these, learners calculate the mean, median and mode and then make a comparison.

Activity 3.4 (10 min)

What can central tendencies tell us?

Show mean and median data for Ethiopia - units of honey produced and percentage marketed on slide 12 Slideshow 3 and years of education and wealth on slides 13 in Slideshow 3 or on worksheet 'Ethiopia_Mean_Median' in spreadsheet: Session 3.

Ask learners to write a few sentences about what these averages show about group and non-group members in Ethiopia. See slide 14 Slideshow 3 for prompts.

Terms of use

Copyright © Think Global and Oxfam GB

www.think-global.org.uk www.oxfam.org.uk

You may use photographs and associated information in this resource for educational purposes at your educational institution. With each use, you must credit the photographer named for that image and Oxfam. You may not use images and associated information for commercial purposes or outside your educational institution. All information associated with these images relates to the date and time the project work took place.

Calculating Mean, Median and Mode – Ethiopian Data Random sample 1, non-group members

- Marital Status = whether or not the woman is married (1=single; 2=married; 3=widowed; 4=separated; 5=divorced; 6=other; 7=too young).
- Ethnic Group = Ethnicity (0=minority ethnic group; 1=majority ethnic group - Amhara in Ethiopia)
- Livelihood dependence = how much of the household's livelihood is dependent on the product (1=all or very close to all; 2=about half; 3=some but less than half; 4=none or almost none)

Age	Marital Status	Years of Education	Ethnic Group	Years of Experience	Livelihood Dependence	Amount Produced	% Marketed	Wealth Index
40	2	0	1	10	3	9	100	36
40	2	0	1	10	4	9		53
45	2	0	0		4	40	100	50
70	2	0	0	50	4	20	100	41
38	2	0	1	1	3	40	100	49
50	2	0	1	7	4	5	100	39
22	2	0	0	4	1	165	91	63
30	2	0	1	8	3	50	100	36
45	2	0	0	10	4	10	100	17
35	2	0	1		3	13	100	26
50	3	0	1	30	4	2	100	11
30	2	0	1	2	4	22	91	38
30	2	0	1	10	4	15	100	36
42	2	0	1	19	4	6	83	28
30	2	0	1	3	3	7	100	18
25	2	0	1	5	4	8	100	33
45	2	0	1		3	25	100	30
60	2	0	0	35	4	3	100	34
35	2	0	1	5	3	29	100	28
40	2	0	1		4	3		41
36	2	4	1		3	23	100	57
35	2	0	1	20	3	14	100	43
35	2	0	1	1	3	5	100	19
30	2	0	1	10	2	32	100	33
30	2	0	1	3	4	5	100	33
32	2	0	1	2		5	100	27
25	2	0	1	3	4	80	100	47
20	2	0	1	5	3	15	100	36
28	2	0	1		3	5	100	26
43	2	0	0	20	4	9	100	28

Calculating Mean, Median and Mode – Ethiopian Data

Random sample 2, non-group members

- Marital Status = whether or not the woman is married (1=single; 2=married; 3=widowed; 4=separated; 5=divorced; 6=other; 7=too young).
- Ethnic Group = Ethnicity (0=minority ethnic group; 1=majority ethnic group - Amhara in Ethiopia)
- Livelihood dependence = how much of the household's livelihood is dependent on the product (1=all or very close to all; 2=about half; 3=some but less than half; 4=none or almost none)

Age	Marital Status	Years of Education	Ethnic Group	Years of Experience	Livelihood Dependence	Amount Produced	% Marketed	Wealth Index
30	2	0	1	4	3	50	100	27
28	2	0	1	5	3	60	100	44
45	2	0	0	20	3	30	100	38
34	2	0	1	3	3	20	100	52
28	2	0	1	5	3	15	67	46
45	2	0	1		3	50	100	54
34	2	2	1	2	4	15	60	55
35	2	0	1	20	4	5	100	41
35	2	0	1	20	3	60	100	24
20	2	1	1	2	4	6	100	36
30	2	8	1	7	3	25	100	38
52	2	0	1		4	20	100	38
28	2	0	0	8	4	7		42
48	2	0	1	6	3	40	100	31
50	2	0	1	10	4	10	100	42
40	2	0	1	23	4	8	100	34
30	2	0	0	10	4	4		34
60	2	0	1	5	4	3	67	39
40	2	0	0	10	3	6	100	21
30	2	0	1		3	70	100	45
60	2	0	1		4	6	100	25
35	2	0	1	5	2	5	60	40
40	2	0	1	10	4	6	100	29
40	2	0	1	2	3	40	100	32
32	2	0	1	5	3	13	100	46
35	2	0	1		4	8	100	51
55	2	0	1	15	3	30	100	35
30	2	0	1	10	4	5	100	29
50	4	0	1	20	1	5	60	39
50	5	0	1	2	3	15	100	16

Calculating Mean, Median and Mode – Ethiopian Data Random sample 3, non-group members

- Marital Status = whether or not the woman is married (1=single; 2=married; 3=widowed; 4=separated; 5=divorced; 6=other; 7=too young).
- Ethnic Group = Ethnicity (0=minority ethnic group; 1=majority ethnic group - Amhara in Ethiopia)
- Livelihood dependence = how much of the household's livelihood is dependent on the product (1=all or very close to all; 2=about half; 3=some but less than half; 4=none or almost none)

Age	Marital Status	Years of Education	Ethnic Group	Years of Experience	Livelihood Dependence	Amount Produced	% Marketed	Wealth Index
28	2	0	1	6	3	40	100	40
28	5	0	1	2	3	25	100	11
40	4	0	1	2	1	3	100	40
32	2	5	1		3	10	100	38
45	2	0	0	20	3	30	100	38
46	2	0	1	3	4	5	100	43
30	2	0	1		3	40	100	33
30	2	0	1	6	3	24	100	25
27	2	0	1	10	3	50	100	30
38	2	0	0					
30	2	0	1	1	2	10	100	42
35	2	0	1	1	3	5	100	19
43	2	0	1	7	4	3		27
35	2	0	1	10	3	30	100	33
25	2	0	1	5	4	58	86	64
40	2	0	1	10	3	9	100	36
27	2	5	1		3	40	100	21
55	2	0	1	4	4	15	67	45
25	2	0	1	6	4	2		37
36	2	0	1	5	3	30	100	21
30	2	0	1	7	2	75	100	29
40	2	0	1	18	4	15	67	51
25	2	0	1	4	3	30	100	22
50	2	0	0	30	3	30	100	35
38	2	0	1		3	11	100	33
45	2	0	1	20	4	14	100	49
55	2	0	1	15	3	30	100	35
18	2	3	1	5	4	30	100	29
45	2	0	1	3	4	2	100	49
20	2	0	1	3	4	34	88	44

Calculating Mean, Median and Mode – Ethiopian Data Random sample 4, WCA group members

- Marital Status = whether or not the woman is married (1=single; 2=married; 3=widowed; 4=separated; 5=divorced; 6=other; 7=too young).
- Ethnic Group = Ethnicity (0=minority ethnic group; 1=majority ethnic group - Amhara in Ethiopia)
- Livelihood dependence = how much of the household's livelihood is dependent on the product (1=all or very close to all; 2=about half; 3=some but less than half; 4=none or almost none)

Age	Marital Status	Years of Education	Ethnic Group	Years of Experience	Livelihood Dependence	Amount Produced	% Marketed	Wealth Index
23	2	0	1	1	3	6	100	30
25	2	0	1	8	2	39	97	35
35	2	0	1		2	1	100	32
30	2	0	1	6	3	15	87	40
55	2	0	1		3	5	100	23
25	2	0	1	1	3	10	100	34
18	2	7	1	3	4	15	100	34
23	2	7	1	5	3	18	83	28
33	2	9	1	13	3	55	95	55
36	2	0	1	10	4	10	100	39
40	2	0	1	10	3	80	100	44
27	2	0	1		2	24	100	30
38	5	0	1					
33	2	0	1	16	3	52	90	71
30	2	0	1	6		40	100	18
30	2	0	1		1	35	100	37
35	2	0	1	10	3	100	95	44
37	2	0	1		3	30	90	31
28	2	4	1	2	3	21	71	37
47	2	0	1	20	2	76	100	82
34	5	0	1	7	3	10	100	8
22	2	8	1	2	3	15	100	27
25	2	0	1	6	3	54	100	30
27	2	0	1	13	2	26	100	45
30	1	0	1	7	3	22	100	25
80	1	0	1		3	30	100	14
28	5	0	1	1	2	30	100	23
25	2	0	1	9	3	160	100	29
36	2	0	1	17	3			81
19	2	8	1		3	15	100	24

Calculating Mean, Median and Mode – Ethiopian Data Random sample 5, WCA group members

- Marital Status = whether or not the woman is married (1=single; 2=married; 3=widowed; 4=separated; 5=divorced; 6=other; 7=too young).
- Ethnic Group = Ethnicity (0=minority ethnic group; 1=majority ethnic group - Amhara in Ethiopia)
- Livelihood dependence = how much of the household's livelihood is dependent on the product (1=all or very close to all; 2=about half; 3=some but less than half; 4=none or almost none)

Age	Marital Status	Years of Education	Ethnic Group	Years of Experience	Livelihood Dependence	Amount Produced	% Marketed	Wealth Index
28	2	0	1	4	3	27	93	57
25	2	0	1	4	3	70	50	35
38	2	0	1	5	2	63	100	40
25	2	3	1	14	2	70	100	25
41	2	0	1	7	3	20	50	42
39	2	0	1	20	3	32	63	61
22	4	5	1					
28	2	5	1	20	3	13	92	39
25	2	0	1	8	2	39	97	35
30	3	0	1		3			15
25	2	0	1	1	3	10	100	34
19	2	8	1		3	15	100	24
30	2	0	1		3	35	100	26
40	2	0	1	15	2	45	100	55
40	2	0	1	17	3	35	100	51
27	2	0	1		2	40	100	52
30	2	0	1	4	3	51	98	34
58	3	0	1					
30	2	0	1					
30	2	0	1	6	2	90	100	54
25	5	0	1	2		33	94	22
40	2	0	1		3	100	100	34
27	2	0	1	13	2	26	100	45
29	2	0	1	2	3	8	100	42
27	2	0	1	8	3	8	100	48
45	2	0	1	2	3	31	94	36
18	2	0	1		2	40	75	29
38	3	0	1	10	4	4	100	12
35	2	0	1	5	3	18	89	44
26	2	0	1	8	3	12	100	66

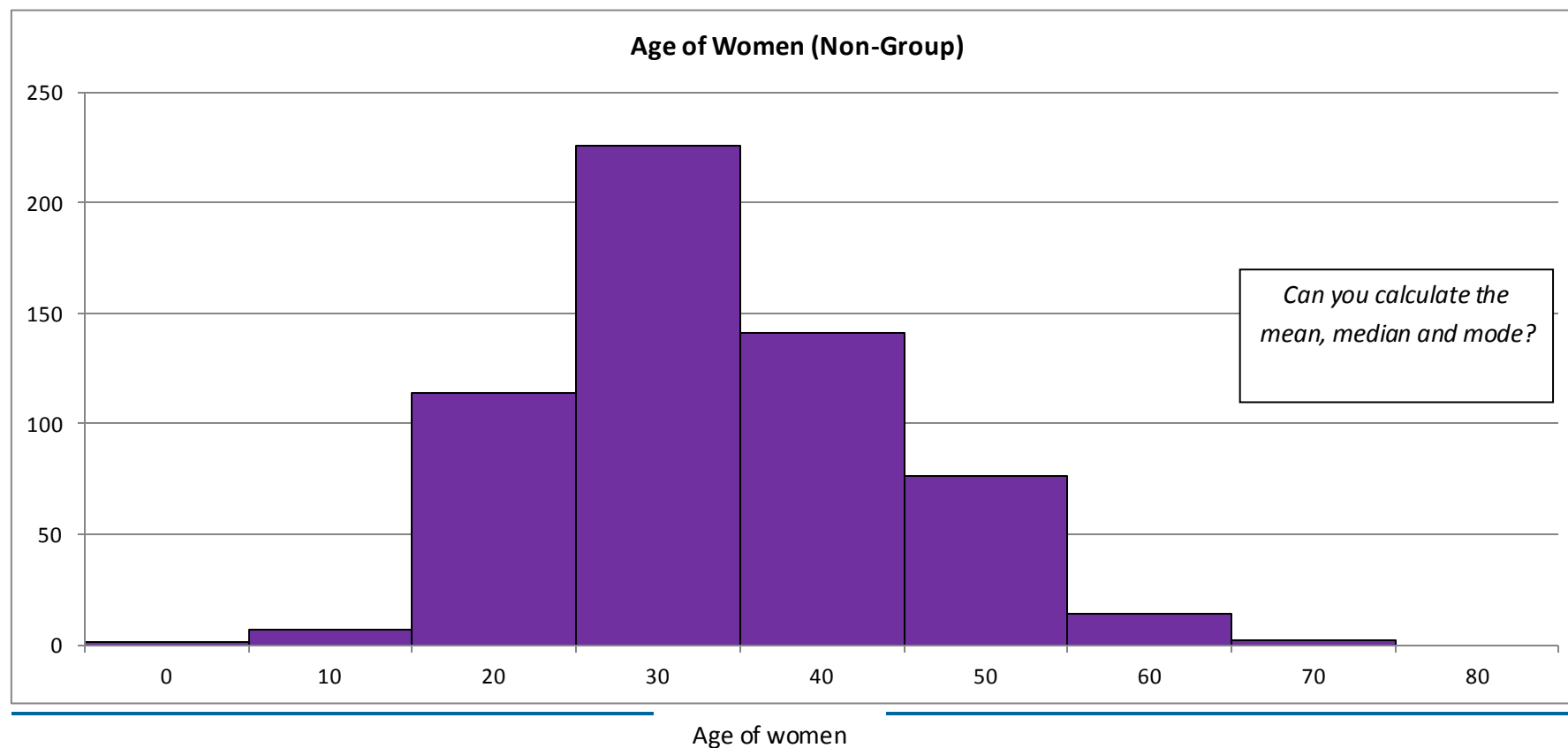
Calculating Mean, Median and Mode – Ethiopian Data Random sample 6, WCA group members

- Marital Status = whether or not the woman is married (1=single; 2=married; 3=widowed; 4=separated; 5=divorced; 6=other; 7=too young).
- Ethnic Group = Ethnicity (0=minority ethnic group; 1=majority ethnic group - Amhara in Ethiopia)
- Livelihood dependence = how much of the household's livelihood is dependent on the product (1=all or very close to all; 2=about half; 3=some but less than half; 4=none or almost none)

Age	Marital Status	Years of Education	Ethnic Group	Years of Experience	Livelihood Dependence	Amount Produced	% Marketed	Wealth Index
25	2	0	1	3	3	50	100	18
36	2	0	1	16	3	28	89	60
27	2	0	1	8	3	8	100	48
38	3	0	1	10	4	4	100	12
26	2	0	1	3	3	8	100	54
37	2	0	1		3	8	100	31
26	2	0	1	4	3	45	100	45
35	2	7	1	8	3	4	100	56
40	2	0	1	20	3	110	100	43
30	2	0	1		4	10	90	27
35	2	0	1	8	3	35	100	35
18	2	0	1		2	40	75	29
57	2	0	1	8	3	75	100	47
45	2	0	1	8	3	95	98	65
38	4	0	1					
28	2	0	1	10	4	3	33	39
22	4	5	1					
40	2	0	1	8	3	60	100	32
30	2	6	1	16	3	310	100	61
30	1	0	1	7	3	22	100	25
25	2	0	1	4	3	70	50	35
34	2	5	1					
25	2	0	1	6	3	90	100	49
25	2	8	1	15	2	60	100	59
45	2	0	1		2	15	100	38
28	2	0	1		2	16	100	25
28	2	0	1	4	3	27	93	57
35	2	0	1		3	180	94	
43	2	0	1	5	3	14	100	55
29	2	0	1	8	3	40	100	45

Calculating Mean, Median and Mode from Grouped Frequency Diagrams

Grouped Frequency Diagrams – The Age of Surveyed Women Farmers in Ethiopia



Calculating Mean, Median and Mode from Grouped Frequency Diagrams Grouped Frequency Diagrams – The Age of Surveyed Women Farmers in Ethiopia

